

## 3.6 Factoring Trinomials by Decomposition.

### Example 1 Multiplying Two Binomials with Positive Terms

Expand:  $(3d + 4)(4d + 2)$



**SOLUTION**



CHECK YOUR UNDERSTANDING

## Factoring a Trinomial by Decomposition

Using example:

$$\begin{aligned} &\text{to multiply } (3h + 4)(2h + 1) \\ &= 3h(2h + 1) + 4(2h + 1) \\ &= 6h^2 + 3h + 8h + 4 \\ &= 6h^2 + 11h + 4 \end{aligned}$$

To factor  $6h^2 + 11h + 4$ , using decomposition, we reverse the steps from above.

Notice that:

- the coefficients of the h-terms have the product:  $3(8) = 24$
- the product of the coefficient of the  $h^2$ -term and the constant term:  $6(4) = 24$

So, to factor  $6h^2 + 11h + 4$ , we decompose the h-term and write it as a sum of two terms whose coefficients have a product of 24.

Factors of 24	Sum of Factors
1, 24	25
2, 12	14
3, 8	11
4, 6	10

The two factors that have a sum of 11 are 3 and 8.

We remove a common factor from the 1st pair of terms, and from the 2nd pair of terms:

$$(6h^2 + 3h) + 8h + 4 = 3h(2h + 1) + 4(2h + 1)$$

common to both

So, this equals:  $(3h + 4)(2h + 1)$

### Example 4 Factoring a Trinomial by Decomposition

Factor.

a)  $3s^2 - 13s - 10$

Step One: multiply the first and last numbers  $3(-10) = -30$

Step Two: Find all possible factors of -30

$$\begin{array}{cccc} -15, 2 & -3, 10 & 1, -30 & -5, 6 \\ 15, -2 & 3, -10 & -1, 30 & 5, -6 \end{array}$$

Step Three: Which pair adds to make -13?

$$-15, 2$$

Step Four: Replace -13 with the two factors

$$3s^2 - 15s + 2s - 10$$

Step Five: Factor the first two terms and then the last two



SOLUTION

$$\begin{aligned} &3s(s-5) + 2(s-5) \\ &(s-5)(3s+2) \end{aligned}$$



CHECK YOUR UNDERSTANDING



b)  $6x^2 - 21x + 9$

$$\begin{array}{l}
 6x^2 - 18x - 3x + 9 \\
 \hline
 6x(x-3) - 3(x-3) \\
 \hline
 (x-3)(6x-3)
 \end{array}$$

54  
30-24  
10+8

$$\begin{array}{l}
 -54, -1 \\
 -27, -2 \\
 -9, -6 \\
 \boxed{-18, -3}
 \end{array}$$

### Practice Questions:

Pg. 178 #15 (Factor by decomposition)

Step One: multiply the first and last numbers

Step Two: Find all possible factors

Step Three: Which pair adds to make the middle term?

Step Four: Replace the middle term with the two factors

Step Five: Factor the first two terms and then the last two

## Thursday, October 27

- Check and go over homework from yesterday (Pg.178 #15)
- Do practice questions
- Learn how to multiply larger polynomials
- Create a list of all multiplying and factoring examples

**15.** Factor. Check by expanding.

a)  $5a^2 - 7a - 6$

b)  $3y^2 - 13y - 10$

c)  $5s^2 + 19s - 4$

d)  $14c^2 - 19c - 3$

e)  $8a^2 + 18a - 5$

f)  $8r^2 - 14r + 3$

g)  $6d^2 + d - 5$

h)  $15e^2 - 7e - 2$

15. Factor. Check by expanding.

a)  $5a^2 - 7a - 6$

b)  $3y^2 - 13y - 10$

Handwritten work for problem a):

Factors of -30:  $-30, 3, -10, 15, 2, 5, 6, 30, 1$

Factored form:  $5a^2 - 10a + 3a - 6$

Factored form:  $5a(a-2) + 3(a-2)$

Factored form:  $(a-2)(5a+3)$

c)  $5s^2 + 19s - 4$

d)  $14c^2 - 19c - 3$

Handwritten work for problem c):

Factors of -20:  $-20, 20, -1, 5, 4, 10, 2$

Factored form:  $5s^2 + 20s - 1s - 4$

Factored form:  $5s(s+4) - 1(s+4)$

Factored form:  $(s+4)(5s-1)$

d)  $14c^2 - 19c - 3$

$$\begin{array}{l} 14c^2 - 21c + 2c - 3 \\ \hline \textcircled{7c}(\underline{2c-3}) + \textcircled{1}(\underline{2c-3}) \\ \hline (2c-3)(7c+1) \end{array}$$

$$14(-3)$$

$$-42$$



$$6, 7$$

$$42, 1$$

$$\textcircled{-21, 2}$$

$$3, 14$$

e)  $8a^2 + 18a - 5$

f)  $8r^2 - 14r + 3$

g)  $6d^2 + d - 5$

h)  $15e^2 - 7e - 2$



CHECK YOUR UNDERSTANDING

4. Factor.

a)  $8p^2 - 18p - 5$

b)  $24h^2 - 20h - 24$

Handwritten solution for problem a):

$$8p^2 - 20p + 2p - 5$$

$$(4p - 5)(2p + 1)$$

The solution shows the original expression  $8p^2 - 18p - 5$  being rewritten as  $8p^2 - 20p + 2p - 5$ . The terms are then grouped as  $(4p - 5)(2p + 1)$ .

Handwritten solution for problem b):

$$24h^2 - 20h - 24$$

$$4(6h^2 - 5h - 6)$$

$$4(2h - 3)(h + 2)$$

The solution shows the original expression  $24h^2 - 20h - 24$  being factored by pulling out a common factor of 4, resulting in  $4(6h^2 - 5h - 6)$ . The quadratic inside the parentheses is then factored into  $(2h - 3)(h + 2)$ .

$$(x+5)(x+2)$$

$$(x+5)(x^2+3x+10)$$



$$(\underline{x+3})(\underline{x^2+2x+5})$$

$$x^3 + \underline{2x^2} + \underline{5x} + \underline{3x^2} + \underline{6x} + 15$$

$$x^3 + 5x^2 + 11x + 15$$